B.TECH. (AEROSPACE ENGINEERING) (BTAE)

Term-End Examination 01148

December, 2012

BAS-001 : APPLIED PHYSICS

Time : 3 hours *Maximum Marks : 70*

Note : *Question No. 1 is* ***Compulsory****. Attempt* ***five*** *more questions from question No. 2 to 7. Use of scientific* ***calculator*** *is permitted.*

1. Attempt ***any five*** questions from the following : **5x4=20**

(a) Equation of a transverse wave travelling in a rope is given by

$$y = 5 \sin (4.0\ t - 0.02\ x),$$

where y and x are expressed in cm, and time in seconds.

Calculate :

(i) the amplitude, frequency, velocity and wavelength of the wave.

(ii) the maximum transverse speed, and acceleration of a particle in the rope.

(b) A 44.5 N weight is suspended by a helical spring having a constant K = 890 N/m. Neglecting the mass of the spring, find the period t for small amplitudes of vertical vibration.

(c) Both the equations $y_1 = A \sin \omega t$, and $y_2 = \frac{A}{2} \sin \omega t + \frac{A}{2} \cos \omega t$ represents S.H.M. Compute the ratio of the amplitude of the two motions.

(d) Find the K.E. and velocity of proton associated with de-Broglie's wavelength of 0.2865 $\mathring{A}$.

Given that

Mass of proton $= 1.67 \times 10^{-27}$ kg

Charge of proton $= 1.6 \times 10^{-19}$ C

Planck's constant $= 6.625 \times 10^{-34}$ J.S.

(e) The velocity of a particle in S.H.M is given by the equation :

$$v = \omega \cos \left(\omega t + \frac{\pi}{4} \right)$$

where v is in cm/sec ;

If its displacement from the origin at t = 1 sec is $\frac{1}{\sqrt{2}}$ cm, then calculate its displacement at t = 1.5 sec.

(f) Discuss in brief Helium-Neon laser and give some of its practical applications.

2. (a) The period of oscillation of the spring system shown in figure 1 is T. If a spring of $K_2 = 240$ N/m is connected in series with this spring and the same mass suspended at their lower end, then calculate the time period of the system. 3+3+4

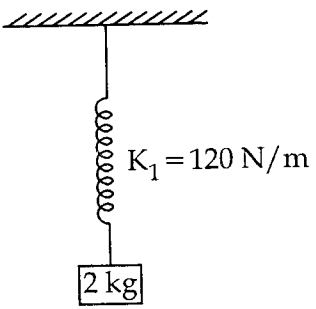

Figure - 1

(b) A body is vibrating with S.H.M. of amplitude 15 cm and frequency 4 Hz. Compute.

(i) the maximum velocity of acceleration and velocity.

(ii) the acceleration and velocity when the particle is 9 cm from the mean position.

(c) A beam of light is incident on a glass plate at an angle of 58°6′ and the reflected beam is found to be completely plane polarised. Find the refractive index of glass.

3. (a) In Young's experiment, the distance of screen from the two slits is 1 m. Light of wavelength 6000 Å is incident on the slits. The width of the fringes is 2 mm. Determine : 3+3+4

(i) distance between two slits.

(ii) the width of the fringes, if the wavelength of incident light is changed to 4800 Å.

(b) Two coherent sources of intensity ratio 64 : 1 interference. Deduce the ratio of intensity between the maximum and minima in the interference pattern.

(c) Write down Einstein's equation for photo-electric effect. What is threshold frequency ?

4. (a) A plane progressive wave is represented by the equation 3+3+4

$$y = 0.5 \sin (314\ t - 12.56\ x).$$

Here x and y are expressed in metre and t in second respectively.

Find (i) amplitude, (ii) wavelength, (iii) frequency, (iv) velocity of the wave, and (v) difference in phase between two points in the path of the wave situated 7.5 m apart.

(b) Two straight narrow parallel slits 2.0 mm apart are illuminated with monochromatic light of wavelength 5896 Å. Fringes are observed at a distance 60 cm from the slits. Find the width of the fringes.

(c) The mean life of a meson is 2×10^{-8} sec. Calculate the mean life of a meson moving with a velocity of 0.8 C.

5. (a) A charged particle accelerated by a potential difference of 200 V has a de-Broglie wavelength equal to 0.0202 Å. Find the mass of this particle and say which particle is it ? **3+3+4**

(b) What is the Brewster angle for air to glass transition ?
Given : refractive index of glass = 1.5

(c) A ray of light is incident on the surface of a transparent plate of refractive index $\sqrt{3}$ at the polarizing angle. Calculate the angle of refraction of the ray.

6. (a) In Young's experiment the distance between the two slits is 0.03 cm and on a screen placed at a distance of 1.5 m, the fourth bright fringe is at a distance of 1 cm from the central fringe. What is the wavelength of the light ? **3+3+4**

(b) The photoelectric threshold wavelength of silver is 2762 Å. Calculate

(i) the maximum kinetic energy of ejected electrons.

(ii) the maximum velocity of the electrons.

(iii) the stopping potential when the silver surface is illuminated with ultraviolet light of wavelength 2000 Å.

(c) Calculate the de Broglie wavelength of an α particle of mass 6.62×10^{-27} kg moving with a velocity of 8×10^4 ms^{-1}.

7. (a) Light travelling in air strikes a glass plate at a glancing angle 33°. While striking the glass plate, part of the beam is reflected and part is refracted. If the refracted and reflected beams make an angle 90°, with each other, then **3+3+4**

(i) What is the refractive index of the glass ?

(ii) What is the critical angle for that glass ?

(b) What are approximate wavelength range for X-ray, laser, and ordinary light (visible) ? Which way are they similar and which way they differ ?

(c) Describe in brief the working of Ruby Laser. Explain the properties of Ruby Laser.